

How Are Traits Related to Problem Behavior in Preschoolers? Similarities and Contrasts Between Temperament and Personality

Sarah S. W. De Pauw · Ivan Mervielde ·
Karla G. Van Leeuwen

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Abstract The lack of empirical research relating temperament models and personality hinders conceptual integration and holds back research linking childhood traits to problem behavior or maladjustment. This study evaluates, within a sample of 443 preschoolers, the relationships between children's maladaptation and traits measured by three temperament models (Thomas and Chess, Buss and Plomin, and Rothbart), and a Five-Factor based personality model. Adequate reliabilities and expected factor structures are demonstrated for most scales. A joint principal component analysis combining 28 temperament and 18 personality scales indicates a six-factor model, distinguishing Sociability, Activity, Conscientiousness, Disagreeableness, Emotionality, and Sensitivity. Regression analyses reveal that although single temperament and personality scales explain from 23% to 37% of problem behavior variance, the six components explain from 41% to 49% and provide a clearer differentiation among CBCL-problem scales. This age-specific taxonomy refines and corroborates conclusions based on narrative reviews and furnishes a more balanced view of trait-maladjustment relationships.

Keywords Temperament · Personality · Trait structure · Problem behavior · Maladjustment · Preschoolers

S. S. W. De Pauw (✉) · I. Mervielde
Department of Developmental,
Personality and Social Psychology, Ghent University,
Henri Dunantlaan 2,
B-9000 Ghent, Belgium
e-mail: Sarah.DePauw@UGent.be

K. G. Van Leeuwen
Centre for Parenting, Child Welfare and Disabilities,
Catholic University of Louvain,
Andreas Vesaliusstraat 2 - box 3765,
3000 Louvain, Belgium

How Shall We Speak of Individual Differences in Preschoolers?

Today, temperament has become the generally acknowledged term to refer to the study of individual differences in infants, toddlers, preschoolers and school-age children. Traditionally, *temperament* refers to individual differences that appear from birth onward, remain relatively stable across the lifespan, and presumably have a strong genetic or neurobiological basis (Goldsmith et al. 1987). However, notwithstanding a long history of investigation, there is still considerable discussion about an acceptable definition of temperament and little consensus on the main dimensions underlying temperamental traits (Goldsmith et al. 1987; Halverson et al. 2003). As a consequence, temperament research is based on and contributes to an ever expanding array of constructs and instruments, making the integration of research findings across different frameworks one of the biggest challenges of contemporary temperament research (Rettew and McKee 2005; Tackett 2006).

The debate on trait structure in children has become even more complicated in the last decade by describing differences among children and adolescents as with *personality* traits, historically qualifying adult individual differences. Traditionally, temperament was distinguished from personality as representing the biologically-based affective, activation and attentional core of personality (Rothbart and Bates 1998, 2006). Personality, often defined as 'the consistent patterns of thoughts, feelings, and actions that people demonstrate', was conceived as wider in scope, including thoughts, skills, values, defenses, morals, beliefs, and social cognitions (Rothbart and Bates 2006). However, this theoretical divide is not backed up by empirical research, leading some prominent authors to suggest that the conceptual distinction between temperament and

personality is more historical than substantive (Caspi et al. 2005; McCrae et al. 2000; Shiner and Caspi 2003).

The classic bifurcation between temperament and personality has been particularly challenged by evidence demonstrating that the Big Five taxonomy of individual differences among adults (Goldberg 1990; McCrae and Costa 1987) also represents individual differences in children and adolescents. This personality taxonomy postulates five bipolar dimensions usually referred to as Neuroticism, Extraversion, Openness-to-Experience, Agreeableness and Conscientiousness. Several independent research groups have now traced comparable dimensions in adolescents and children, adopting a variety of strategies, informants, and methods of assessment (e.g. Digman and Shmelyov 1996; Halverson et al. 2003; John et al. 1994; Mervielde and De Fruyt 2002).

A growing body of research suggests that this five-factor personality model also accounts for the structure of behavioral individuality of children from the preschool years onwards. Although preschoolers' traits have been studied by classic temperament researchers such as Thomas and Chess, Buss and Plomin, and Rothbart (Buss and Plomin 1975; McDevitt and Carey 1978; Rothbart et al. 2001), recent studies have retrieved the five personality factors from adult ratings of children as young as age 2 (Lamb et al. 2002), age 3 to 4 (Abe 2005; Abe and Izard 1999; Asendorpf and Denissen 2006; Halverson et al. 2003; Zupancic et al. 2006), and even from self-reports of children aged 5 (Measelle et al. 2005).

However, the current evidence on the five-factor structure of traits in preschoolers is not as convincing as the evidence for school-age children and adolescents. First, some traits assessed in these younger children show limited internal consistency (Lamb et al. 2002; Measelle et al. 2005). Second, and more important, the factor structures retrieved in preschoolers diverge somewhat from factor

solutions emerging from studies with older age groups. These discrepancies may reflect developmental differences in the nature of these traits but they may also depend on idiosyncratic properties of the chosen instruments. To date, only two instruments have been used to recover this five-factor structure from parental reports on preschoolers: the California Child Q-sort (CCQ; Abe 2005; Abe and Izard 1999; Asendorpf and Denissen 2006; Lamb et al. 2002) and the Inventory of Childhood Individual Differences (ICID; Halverson et al. 2003; Zupancic et al. 2006). However, factor analyses of both instruments show deviations from the traditional Big Five, such as additional traits beyond the Big Five for the CCQ (Abe and Izard 1999; John et al. 1994), and a more heterogeneous content for the Extraversion factor, including aspects of Agreeableness and Openness for the ICID (Mervielde et al. 2005). Therefore, more research based on alternative instruments is needed to assess to what extent the five-factor structure of personality can fully and adequately represent trait differences among preschool children (Caspi and Shiner 2006).

Conceptual Attempts to Capture the Basic Dimensions Underlying Childhood Traits

To facilitate integration of the multitude of constructs used to label temperament or personality traits in children, some theorists have traced the more or less independent trait components emerging from factor analyses of various data sets. Table 1 synthesizes Mervielde and Asendorpf (2000)'s in-depth literature review of relatively independent *temperament* dimensions emerging from the prominent models of Thomas and Chess, Buss and Plomin, and Rothbart, together with Caspi and Shiner's (2006) compelling common taxonomy of *temperament and personality* traits covering individual differences emerging from the preschool years onwards.

Table 1 Conceptual Comparison of Dimensions Emerging from Three Temperament Models and the Five-Factor Model of Personality

Common dimensions of temperament (based on Mervielde and Asendorpf 2000)

	<i>Emotionality</i>	<i>Extraversion</i>	<i>Activity</i>	<i>Persistence</i>
Thomas-Chess	Negative Emotionality	Inhibition	Activity Level	Task persistence
Buss-Plomin	Emotionality	Sociability	Activity	
		Shyness		
Rothbart	Negative Affectivity	Surgency	Surgency	Effortful Control ^a
Common dimensions of temperament and personality (based on Caspi and Shiner 2006)				
	<i>Neuroticism</i>	<i>Extraversion</i> ^b	<i>Conscientiousness</i>	<i>Agreeableness</i> ^c <i>Openness-to-Experience</i> ^{c, d}

^a This trait is thought to mature throughout at least the preschool period

^b In personality taxonomies, Activity is conceptually subsumed by a broader Extraversion-component

^c This dimension has not been recognized by temperament researchers as an independent trait dimension for children (including preschoolers)

^d In five-factor personality research, the definition, internal consistency, and developmental differentiation of this trait remain questionable in childhood (especially in children below age 6)

A Joint Taxonomy for Temperament

In their narrative literature review (Table 1—upper part), Mervielde and Asendorpf (2000) postulate that at least four dimensions are necessary to capture the content of the major temperament models developed by Thomas and Chess, Buss and Plomin, and Rothbart. They labeled them as Emotionality, Extraversion, Activity, and Persistence. Emotionality, chiefly referring to the tendency to experience negative emotions, is clearly present in each of the three models. A second consistent dimension is captured with the more general label Extraversion and refers to sociability versus social inhibition. Interestingly, these authors isolated Activity as a third independent factor as it is strongly imbedded in the Thomas and Chess and the Buss and Plomin model and subsumed by the Surgency factor in Rothbart's model. Finally, Persistence (or Effortful Control according to Rothbart) is present in only two temperament models, which might reflect that this is just emerging prior to kindergarten.

A Common Taxonomy for Temperament and Personality

When comparing the dimensions proposed by either temperament or personality research, striking similarities in terminology emerge. Given this overlap, many authors now argue that the traditional dimensions of temperament are closely related to the Big Five (Caspi et al. 2005; Mervielde and Asendorpf 2000; Rothbart and Bates 1998, 2006; Shiner 1998; Shiner and Caspi 2003) and that, at least from preschool age onwards, temperament and personality traits increasingly appear to be 'more alike than different' (Caspi et al. 2005, p. 454). In particular, Shiner (1998), Shiner and Caspi (2003), Caspi et al. (2005), and Caspi and Shiner (2006) made a compelling case for the development of a common taxonomy of temperament and personality aiming to cover individual differences emerging from the preschool years onwards. Such taxonomy not only facilitates communication among researchers but also helps to trace the common structure and to document similarities and differences between temperament and personality.

The latest version of this conceptual taxonomy (Caspi and Shiner 2006; Table 1, lower part) postulates five higher-order dimensions at the top level: Neuroticism (or Negative Emotionality), Extraversion, Conscientiousness (or Constraint), Agreeableness, and Openness-to-Experience (or Intellect). As is evident from the labels, these superfactors combine major temperament and the adult Big Five dimensions. Comparing these with the dimensions postulated by Mervielde and Asendorpf (2000) shows that Neuroticism, Extraversion, and Conscientiousness have clear counterparts in temperament literature. Yet, Activity, an important and independent temperament

construct, is conceived as a facet of the overall Extraversion dimension.

In addition, the Shiner/Caspi common taxonomy includes Agreeableness and Openness-to-Experience as major dimensions of the common structure. Although Agreeableness includes a variety of traits typically studied by developmental psychologists (e.g. empathy, warmth, versus egocentrism, antagonism), it has not been recognized by temperament researchers as a major *independent* dimension. However, this does not preclude that Agreeableness can be identified if appropriate items referring to this type of behavior are included (Caspi and Shiner 2006; Halverson et al. 2003). The same reasoning might apply to Openness-to-Experience. Content representing Openness is almost completely ignored by temperament models. Although Openness remains the most debated and least understood dimension of the Big Five, analysis of free parental descriptions of children convincingly shows that most parents spontaneously focus on intellectual abilities, creativity and to a lesser extent on openness to ideas and actions (Mervielde et al. 1995). However, the internal consistency of this factor in children younger than age 6 remains questionable (Caspi and Shiner 2006; Lamb et al. 2002).

How Are Traits Related to Problem Behavior in Preschoolers?

One advantage of these conceptual taxonomies is that they facilitate establishing links between traits and maladaptation (Frick 2004; Mervielde et al. 2005; Tackett 2006). To date, an increasing number of researchers narratively reviewed this literature attempting to integrate different concepts, taxonomies and instruments targeting temperament (e.g. Muris and Ollendick 2005; Nigg 2006; Rettew and McKee 2005; Rothbart 2007; Rothbart and Bates 1998, 2006; Rothbart and Posner 2006) or personality (e.g. Caspi and Shiner 2006; Mervielde et al. 2005, 2006; Tackett 2006).

According to these reviews, traits play an important role in the etiology and stability of childhood disorders. The growing literature on five-factor-based personality and childhood maladaptation has recently been reviewed by Mervielde and colleagues (2005, 2006). These authors developed a bold proposal on how child personality and psychopathology are related, based on multi-method, multi-informant data derived from both general and clinic-referred samples of school age children and adolescents. This model proposes that Neuroticism/Emotionality and Extraversion are the major correlates of internalizing problems, while Agreeableness and Conscientiousness are primarily associated with externalizing problem behavior. Markedly, the fifth personality dimension, Openness-to-

Experience, is not regarded as a major or consistent correlate of childhood problems. A similar pattern emerges from reviews on the role of temperament in children's adjustment. Temperament researchers document strong links between Emotionality and Shyness/Social Inhibition and the development of internalizing problems. Likewise, there is also abundant evidence linking externalizing problems to lower levels of Persistence/Effortful Control.

However, in spite of apparent similarities, some remarkable discrepancies between the perspective of temperament and personality research on problem behavior should be emphasized, impeding an unequivocal evaluation of the trait–maladaptation literature. First, temperament researchers advocate that Persistence/Effortful Control is also important for understanding internalizing problems. They contend that a lack of attention control, impeding the redirection of attention away from threat or worry cues, accompanies higher levels of anxiety or depressive problems (Lonigan et al. 2004; Muris et al. 2007). This link has been hardly emphasized by personality researchers, although occasionally a moderate correlation between Conscientiousness and internalizing problems has been reported (e.g. Mervielde et al. 2005).

Second, temperament researchers emphasize the link between higher Emotionality and the frequency of externalizing behavior. To accommodate this difference, theorists (Rothbart and Posner 2006) recently suggest that the Emotionality-factor should be decomposed into fear and sadness on the one hand, and anger and irritability on the other. Fear and sadness (typically considered to be facets of Neuroticism in personality research) are related to internalizing disorders; whereas anger and irritability (in personality taxonomies, these traits are conceived as facets of Agreeableness) correlate with externalizing disorders.

Third, temperament research also suggests a positive relation between Extraversion/Surgency and externalizing problems. This link might be primarily the result of elevated activity levels. Heightened activity is a main feature of children with hyperactivity problems but also characterizes children with disruptive behavior problems (Nigg 2006). In personality models, Activity is typically designated as a lower-order facet of Extraversion, explaining why it sometimes acts as an additional but weaker predictor of externalizing problems, especially in general population samples (Caspi and Shiner 2006; Mervielde et al. 2005). Alternatively, the documented stronger link between temperamental Surgency and Externalizing could also be the result of heightened impulsivity or of increased frustration in response to non-reward. In personality taxonomies, impulsivity and irritability are usually allocated to different factors: impulsivity is considered to be an indicator of low Conscientiousness, while irritability reflects low Agreeableness.

The Need for an Empirical Evaluation of Conceptual Reviews

The above described narrative reviews are mainly based on *conceptual* analyses because empirical evidence on the relationships among temperament models and between temperament and personality models is essentially lacking. There have been a few attempts that evaluated the discriminant and convergent validity across different temperament models (e.g. Gibbs et al. 1987; Goldsmith et al. 1991). However, these studies relied on very small samples sizes and reported major psychometric weaknesses of the temperament scales precluding the evaluation of their latent structure.

Similarly, only two studies have empirically addressed the link between temperament and personality traits, one based on self-ratings of adults and one on teacher ratings of school age children. A joint principal component analysis of adult temperament and personality scales showed that adult temperament and personality scales fit reasonably well with the Big Five (Angleitner and Ostendorf 1994). Digman and Shmelyov (1996) investigated these relations with teacher-ratings of Russian 8-to-10 year old children. Twenty-one of a set of behavioral descriptions were considered to be indicators of temperament traits while 28 were classified as assessing personality. Interestingly, the joint principal component analysis of these indicators yielded five components that again were strikingly similar to the Big Five.

Pitfalls of the Current Conceptual Analyses

As there is no guarantee that semantically similar labels actually share the same trait variance, the conceptual integration of different trait frameworks without sufficient empirical evidence is hazardous. Additionally, semantically dissimilar labels may share the same variance. This phenomenon, which has been called in the literature as the “jingle–jangle” fallacy (see Block 1995), reminds researchers that they sometimes study the same trait under different names (jingle) or use the same label to describe different traits (jangle). Hence, what is missing and might challenge or complement the current conceptual reviews is an empirical evaluation of the relationships among several trait measures including scales from the temperament and the personality domain.

Several researchers now recommend joint factor analytic studies to ‘empirically integrate the two languages of temperament and personality’ (Tackett 2006, p. 594) and to derive the broad dimensions underlying children's traits (Caspi and Shiner 2006; Mervielde et al. 2005; Rothbart and Bates 2006). Additionally, joint factor analytic work is also needed to decide on the location of ambiguous traits

(such as anger/irritability, impulsivity, activity) in joint taxonomies of temperament and personality (Caspi and Shiner 2006; Rothbart and Bates 2006). Finally, empirically delineating these taxonomies will not only clarify the relationships among trait models, but it will also facilitate a more unequivocal evaluation of how traits relate to childhood maladjustment (Halverson et al. 2003; Shiner and Caspi 2003).

A final concern, inadequately addressed by the current conceptual analyses, is the role of development in the structure of children's traits and their influences on adjustment. Given the lack of sufficient empirical data, most conceptual reviews to date do not propose age-related and distinct trait structures for preschool and school-age children. However, with increasing age, the structure of children's traits may become more complex (Caspi and Shiner 2006), encouraging the development of age-specific measures of temperament or personality. Hence, empirically-grounded age-specific investigations of the divergences and convergences among childhood trait taxonomies are warranted.

The Present Study

The present research evaluates relationships among three prominent temperament models and one five-factor-based personality model in order to search for the 'broad' dimensions representing traits in preschool children and to elucidate how these traits are linked to problem behavior in this age group. Temperament was assessed with three widely-used and age-appropriate instruments as exemplars representing the influential theories of Thomas and Chess, Buss and Plomin, and Rothbart. In addition, we evaluated the comprehensiveness of a five-factor-based personality instrument (originally targeted to school age children) to describe preschoolers' trait variability. In the analyses, we first explore the common structure of the included temperament and personality scales. Second, we determine the relationships between temperament and personality traits and preschool maladjustment, based on the four different trait models and on the common structure.

Method

Participants and Procedure

Parents of 443 4- and 5-year old children (mean age 4.85; SD 0.68 years) were either randomly selected from preschool facilities (Sample 1, $N=254$) or recruited by undergraduate students (Sample 2, $N=189$). For Sample 1, 48 preschool facilities geographically spread across Flanders were asked to take part in this study and to randomly distribute informed consent forms among parents of

children attending kindergarten. Ninety-six percent of the contacted parents agreed to participate and received via the teacher a set of questionnaires with detailed written instructions. They returned the completed set of instruments to the teacher in a sealed envelope. Sample 2 was a convenience sample, recruited by undergraduate psychology students who invited two families from their social environment (no first-grade family members) with a child in kindergarten¹ to participate in a study on child development. These families were visited at home where they independently filled in the instruments in the presence of the student.

The 207 boys and 236 girls were rated, by two primary caregivers, on temperament, personality and problem behavior. In Sample 1, only one of three temperament models² was included together with the personality and broadband problem behavior measure, while for Sample 2, parents rated all three temperament models, personality and problem behavior. In both samples, temperament and personality questionnaires were equally and randomly divided over mothers and fathers in order to reduce questionnaire load and informant bias.³ In Sample 1, the problem behavior measure was randomly filled in by mother or father, whereas in Sample 2, this instrument was always completed by the mother.

All parents were Caucasian and their professional status was as follows: 5% of the parents were unemployed, 23.1% were lower-skilled workers, whereas 45% and 26.4% were middle class and upper-class workers. Ninety-four percent of the total sample were either married or living together. Mother's average age was 34.4 (SD=4.01) while fathers were on average 36.8 years (SD=4.79). Chi-square analyses revealed no significant demographic differences between the two subsamples.

Instruments⁴

Thomas and Chess model We administered the Dutch version (Leenders et al. 1992) of the Behavioral Styles Questionnaire (BSQ; McDevitt and Carey 1978), a prominent measure of the nine temperament dimensions proposed

¹ In the Flemish community of Belgium, almost 100% of the children access kindergarten from age 3.

² Consequently, analyses including these temperament scales are based on a varying N .

³ Analyses of variance revealed no significant mean differences ($p<0.05$) between mothers and fathers ratings of problem behavior. Adopting the $p<.01$ level, no differences were found between paternal and maternal ratings of temperament and personality. When the threshold was set to $p<0.05$, two differences were found: Fathers rated their preschoolers lower on CBQ-Effortful Control ($F(1, 265)=5.54, p=0.02$) and on BSQ-Threshold/Distractibility ($F(1, 246)=5.97, p=0.02$).

⁴ Reports of the described analyses are available upon request with the first author.

by Thomas and Chess for children aged 3 to 7, to parents of 248 preschoolers. This instrument contains 100 items and assesses the dimensions Activity level, Regularity, Adaptability, Approach-Withdrawal, Threshold of responsiveness, Intensity of reaction, Quality of mood, Distractibility, and Persistence. Reliabilities for the nine BSQ-scales averaged 0.65, ranging from 0.44 to 0.79. Internal consistency was rather low for the Regularity (0.44) and the Threshold of responsiveness scale (0.45). Scree plot analysis indicated three varimax-rotated principal components accounting for 64% of the variance. High scorers on the first component, Adaptability-Mood (26% explained variance), are primarily portrayed as less adaptable children displaying a more negative quality of mood and more withdrawal. The second component (21%), Threshold-Distractibility, is marked by lower threshold of responsiveness, higher distractibility and reaction intensity, and more irregularity.⁵ The third component, Activity/Persistence (17%), classifies higher activity-level and lower persistence.

Buss and Plomin model The Dutch translation (Boer and Westenberg 1994) of the EAS Temperament Survey (EAS; Buss and Plomin 1984) measures the four criterial dimensions of temperament proposed by Buss and Plomin: Emotionality, Activity, Sociability and Shyness. This 20-item scale, targeted at children aged 1 to 9 years was administered to parents of 276 preschoolers. Reliabilities for the EAS-scales averaged 0.73, with a rather modest α of 0.57 for Sociability. Although the EAS only contains four scales, we nevertheless extracted three varimax-rotated principal components, accounting for 89% of the variance, in order to create orthogonal component scores: Sociability/Shyness (37%), Emotionality (27%), and Activity (25%).

Rothbart model The Dutch version (Majdandzic and van den Boom 2007) of the Child Behavior Questionnaire—short form (CBQ; Putnam and Rothbart 2006) assesses the temperament dimensions outlined by the psychobiological model of Rothbart and colleagues. This 94-item caregiver report, designed for children 3 to 7 years, was completed by 287 parents. The CBQ measures 15 primary temperament characteristics that are assigned to three higher-order components: Extraversion/Surgency (combining the subscales Activity Level, Impulsivity, High Intensity Pleasure, and Shyness), Negative Affect (Anger/Frustration, Discomfort, Fear, Sadness, and Soothability), and Effortful Control

(Attentional Focusing, Inhibitory Control, Low Intensity Pleasure, and Perceptual Sensitivity). Two additional scales, Approach/Positive Anticipation and Smiling/Laughter, are found to be inconsistent with respect to primary loadings and are hence not assigned to a higher-order dimension in the model. Reliabilities for the CBQ-scales averaged 0.69, ranging from 0.56 for Sadness to 0.86 for Shyness. Three extracted and varimax-rotated principal components, accounting for 55% of the variance, reveal a structure that parallels the three higher-order dimensions proposed by Putnam and Rothbart (2006): Surgency (20%), Negative Affect (18%) and Effortful Control (17%). Only the Shyness scale fails to have its highest loading on the expected Surgency component (−0.34) and loads primarily on the Negative affect component (0.54).

Five-Factor model The Hierarchical Personality Inventory for Children (HiPIC; Mervielde and De Fruyt 2002) was used to measure five-factor personality and was administered to 431 parents of 4- and 5-year olds. The HiPIC includes 144 items, which were based on an extensive set of parental personality descriptions of children aged 6 to 12. The HiPIC assesses 18 facets hierarchically structured under five factors that are clearly related to adult personality dimensions: Conscientiousness (comprising the facets Achievement Motivation, Concentration, Perseverance, and Orderliness), Benevolence (Egocentrism, Irritability, Compliance, Dominance, and Altruism), Extraversion (Shyness, Optimism, Expressiveness, and Energy), Emotional Stability (Anxiety and Self-confidence), and Imagination (including the subscales Creativity, Curiosity, and Intellect). The Benevolence and Imagination domain are empirically and conceptually related to Agreeableness and Openness-to-Experience from the Big Five (De Fruyt et al. 2000). Internal consistencies for the 18 HiPIC facets average 0.81, ranging from 0.73 for Creativity and Self-Confidence to 0.87 for Shyness and Irritability. Varimax-rotated extraction of five principal components, explaining 72% of the variance, clearly confirms the five-factor structure of the HiPIC: Conscientiousness (16%), Benevolence (15%), Extraversion (14%), Emotional stability (12%) and Imagination (15%). The Altruism scale is the only scale that fails to have its highest loading on the expected Benevolence component but primarily loads Extraversion (0.59). Nevertheless, Altruism has a fairly high loading (−0.49) on Benevolence.

Broad dimensional screening of problem behavior The preschool version of the Child Behavior Checklist (CBCL 1,5–5; Achenbach and Rescorla 2000) was administered to parents of 430 preschoolers. The 100 CBCL items target 7 narrow-band syndromal constructs grouped into two second-order factors: Internalizing and Externalizing problems.

⁵ Given the low internal consistencies of the BSQ-Threshold and BSQ-Regularity scale, it is possible that these two scales load on a common factor due to their shared, low reliability. Secondary principal component analyses were conducted excluding these two scales, but this did not alter the results as the second BSQ-component still combines Distractibility and Intensity of reaction. Principal axis factoring yielded an identical factor solution.

A Total problem score combines scores on all the items. This study also includes data on the recently developed five DSM-oriented scales: affective problems, anxiety problems, pervasive developmental problems, attention deficit hyperactivity problems and oppositional defiant problems. These scales allow a more fine-grained analysis of trait-maladaptation patterns relying on typical DSM diagnostic categories. Reliabilities for the global scales Internalizing (0.86), Externalizing (0.90) and Total problems (0.94) are uniformly high. Cronbach α 's for the five DSM-oriented scales average 0.70, ranging from 0.53 (Affective problems) to 0.81 (Oppositional defiant problems). Because Flemish or Dutch norms for this CBCL-version are not yet available, analyses were based on raw CBCL-scores. In the present sample, symptoms are mainly low-grade, non-clinical problems. Relative to US norms, only a small set of preschoolers met criteria for borderline ($N=23$) and clinical ($N=9$) elevation of scores on the CBCL Total Problems scale.

Results

Empirical Assessment of the Common Structure of Temperament and Personality

To test the correspondence among temperament and personality scales, we applied a principal component analysis to the intercorrelation matrix of the 28 temperament and 18 HiPIC personality scales.⁶ Inspection of the plot of eigenvalues indicated a six-component structure accounting for 56% of the total variance. Therefore, six components were extracted and rotated by varimax. The rotated solution is shown in Table 2.

The first component is loaded by BSQ Approach-withdrawal, EAS Shyness and Sociability, CBQ Shyness, and three HiPIC Extraversion scales (Shyness, Expressiveness, and Optimism). Given that this component clearly loads all the Shyness/Sociability scales from the temperament questionnaires in combination with typical Extraversion (HiPIC-personality) facets, we labeled this component *Sociability* as it relates to the preference to be with others and in addition points towards feelings of discomfort in social situations.

The second extracted component has high loadings for CBQ Activity, HiPIC Energy, EAS Activity and BSQ Activity and hence combines all activity scales from the

temperament and personality questionnaires. This component is also moderately loaded by a diverse set of CBQ scales: two Surgency scales (High Intensity Pleasure and Impulsivity), CBQ Approach, and one Effortful Control scale, Inhibitory Control. Although these latter four scales appear to be semantically distinct from activity-related behavior, they all encompass initiation or inhibition of motor responses. Both CBQ-High-Intensity Pleasure and Approach refer to the vigorous experience of excitement (e.g. behaviorally defined as 'having trouble sitting still' or 'thrilling') in anticipation of highly intense or positive situations. Given the predominance of activity-related content, we decided to label this component as *Activity*.

The third component extracted from the combined set of temperament and personality scales is primarily loaded by each of the four HiPIC Conscientiousness facets (Concentration, Achievement Motivation, Persistence, and Orderliness), CBQ Attention Focusing, and BSQ Persistence/Attention span. Remarkably, this component combines both Conscientiousness and Imagination content as the three HiPIC Imagination facets also have their highest loading on this component. Given the preponderance of content referring to attentional and self-control processes that may be used in service of completing tasks or striving to meet standards, we decided to label this component as *Conscientiousness*.

The fourth component is highly loaded by each of the five HiPIC Benevolence facets (Egocentrism, Compliance, Irritability, Dominance and Altruism) together with CBQ Anger and BSQ Inadaptability and Quality of Mood. Because of the predominance of evaluatively negative content indicating low quality of interpersonal interactions, we labeled this component as *Disagreeableness*.

The fifth principal component combines a set of typical emotionality scales: BSQ Intensity of Reaction and low Threshold of Responsiveness, EAS Emotionality, three CBQ Negative Affect scales (Fear, Discomfort, Anger), and HiPIC Anxiety. Therefore, it seemed appropriate to label this component *Emotionality* because it primarily reflects tendencies to experience the world as distressing and threatening.

A smaller sixth component was exclusively loaded by scales from the temperament questionnaires. This component was primarily loaded by four CBQ scales (Perceptual Sensitivity, Low Intensity Pleasure, Soothability, Smiling/Laughter) together with BSQ Regularity. This group of scales is remarkably similar to the 'Orienting Sensitivity' component emerging from a factor analysis of Rothbart's Revised Infant Temperament Questionnaire scales (Gartstein and Rothbart 2003). In 3- to 12-month-old children, this factor loads infancy-adapted descriptors of Low Intensity Pleasure, Soothability, Cuddliness, Duration of Orienting (the latter two scales don't have CBQ-equivalents) and Smiling/Laughter. Gartstein and Rothbart (2003) hypothe-

⁶ In line with previous empirical research on the common structure of temperament and personality (Angleitner and Ostendorf 1994; Digman and Shmelyov 1996), we applied principal component analysis with varimax rotation in order to create orthogonal trait components and to avoid multicollinearity of predictors in the subsequent multiple regressions. Correlation coefficients for each pair of variables were computed based on all cases with valid data for that pair ($N=248-432$).

Table 2 Joint Principal Component Analysis of BSQ, CBQ, EAS and HiPIC Scales

	SOC(R)	ACT	CON	DIS	EMO	SEN
BSQ/approach-withdrawal	<i>0.79</i>	−0.15	−0.20	0.15	0.17	0.23
EAS/shyness	<i>0.79</i>	−0.08	0.02	0.05	0.19	−0.03
HiPIC/E/shyness	<i>0.78</i>	−0.19	−0.18	0.15	0.10	−0.02
CBQ/SU/ shyness	<i>0.77</i>	−0.18	−0.10	0.01	0.20	−0.06
HiPIC/E/expressiveness	−0.57	0.19	0.30	0.09	0.17	0.32
EAS/sociability	−0.51	0.22	−0.16	−0.10	0.06	0.23
HiPIC/E/optimism	−0.42	0.26	0.30	−0.36	−0.04	0.30
CBQ/SU/activity level	−0.08	<i>0.84</i>	−0.01	0.03	−0.01	−0.12
HiPIC/E/energy	−0.18	<i>0.77</i>	0.06	0.03	0.03	0.13
CBQ/SU/high intensity pleasure	−0.07	<i>0.76</i>	0.08	0.14	−0.20	−0.01
EAS/activity	−0.30	<i>0.76</i>	−0.05	−0.03	−0.03	0.00
BSQ/activity level	−0.14	<i>0.72</i>	−0.21	0.18	−0.02	0.06
CBQ/SU/impulsivity	−0.42	<i>0.63</i>	0.16	0.09	−0.15	0.10
CBQ/APPROACH	0.05	<i>0.53</i>	0.04	0.08	0.28	0.18
CBQ/EC/inhibitory control	−0.04	−0.51	0.23	−0.32	0.05	0.44
HiPIC/C/concentration	0.08	−0.23	<i>0.76</i>	−0.24	−0.16	0.01
HiPIC/C/achievement motivation	−0.11	0.12	<i>0.71</i>	0.04	0.12	0.08
HiPIC/C/persistence	0.05	0.08	<i>0.68</i>	−0.32	−0.13	−0.01
HiPIC/I/intellect	−0.22	0.09	<i>0.66</i>	−0.06	0.02	0.15
CBQ/EC/attention focusing	−0.03	−0.30	<i>0.64</i>	0.10	−0.19	0.33
BSQ/persistence (R)	−0.02	0.33	−0.58	0.16	0.05	0.13
HiPIC/I/curiosity	−0.24	0.22	<i>0.57</i>	−0.01	0.18	0.20
HiPIC/C/orderliness	0.06	−0.23	<i>0.57</i>	−0.36	0.08	−0.02
HiPIC/I/creativity	−0.21	0.09	<i>0.57</i>	−0.03	−0.05	0.32
HiPIC/N/self-confidence	−0.40	0.21	<i>0.52</i>	−0.05	−0.36	0.08
HiPIC/B/egocentrism	0.06	−0.02	−0.13	<i>0.81</i>	0.16	−0.04
HiPIC/B/compliance	−0.07	−0.28	0.28	−0.78	−0.01	0.07
HiPIC/B/irritability	0.10	0.20	−0.21	<i>0.72</i>	0.36	0.01
HiPIC/B/dominance	−0.38	0.19	0.25	<i>0.59</i>	−0.04	0.08
BSQ/quality of mood (R)	0.34	0.05	−0.15	<i>0.54</i>	0.40	0.10
HiPIC/B/altruism	−0.27	0.14	0.16	−0.51	0.21	0.20
BSQ/adaptability (R)	0.46	0.08	−0.27	<i>0.48</i>	0.28	0.15
CBQ/NA/anger	0.33	0.26	−0.01	<i>0.47</i>	0.23	−0.08
BSQ/intensity of reaction	−0.05	0.22	0.01	0.29	<i>0.64</i>	0.05
EAS/emotionality	0.21	0.10	−0.12	0.23	<i>0.63</i>	0.01
BSQ/threshold of response (R)	−0.04	0.07	0.12	−0.06	<i>0.63</i>	0.03
CBQ/NA/discomfort	0.07	−0.23	0.01	0.17	<i>0.59</i>	0.04
CBQ/NA/sadness	0.24	−0.04	0.06	0.06	<i>0.58</i>	−0.08
CBQ/NA/fear	0.19	−0.16	−0.17	−0.06	<i>0.57</i>	−0.01
HiPIC/N/anxiety	0.26	−0.17	−0.27	0.25	<i>0.57</i>	0.09
BSQ/distractibility	−0.35	0.01	−0.01	−0.08	<i>0.46</i>	−0.07
CBQ/EC/perceptual sensitivity	0.05	−0.06	0.17	−0.02	0.20	<i>0.70</i>
CBQ/EC/low intensity pleasure	−0.14	−0.03	0.17	0.00	0.02	<i>0.66</i>
CBQ/SMILING/LAUGHTER	−0.14	0.23	0.25	−0.07	−0.03	<i>0.57</i>
CBQ/NA/Soothability	−0.37	−0.11	−0.03	−0.34	−0.26	<i>0.39</i>
BSQ/Rhythmicity/regularity (R)	0.15	0.14	−0.15	0.04	−0.16	<i>0.35</i>
% Explained variance	11.10	11.09	10.87	9.12	8.58	5.49

Extraction Method: Principal Component Analysis $N=248-432$; Rotation Method: Varimax with Kaiser Normalization. Primary loadings are marked in italics. Higher scores on scales denoted with (R) should be interpreted as more maladaptive.

SOC sociability, ACT activity, CON conscientiousness, DIS disagreeableness, EMO emotionality, SEN sensitivity

size this component to be developmentally related to later emerging Effortful Control. Intriguingly, in a recent factor analysis of their Adult Temperament Questionnaire (ATQ), Evans and Rothbart (2007) extracted a similar ‘Orienting Sensitivity’ factor, independent from Effortful Control. This component encompasses adult-adapted scales for Perceptual Sensitivity and Low Intensity Pleasure. For adults and infants, this ‘Orienting Sensitivity’ construct is described as ‘reactive’ attention to slight changes in the environment. To mark this typical temperament-related content in the present analysis, the sixth component was labeled *Sensitivity*.

The Sociability and Activity component explained respectively 11.10% and 11.09% of the variance, followed by Conscientiousness (10.87%), Disagreeableness (9.12%), and Emotionality (8.58%). Sensitivity explained 5.49% of the variance.⁷

Relationships Between Temperament/Personality Models and Problem Behavior

To provide an overall picture of the relationships between temperament/personality and problem behavior and to avoid multicollinearity problems, CBCL Total, Internalizing, Externalizing and DSM-oriented scale scores were regressed on temperament and personality *component scores*, derived from the principal components extracted from the four questionnaires. For each trait model, analyses incorporate all cases with valid data. Table 3 shows the standardized regression coefficients together with multiple R^2 's indicating how much of the variance of each problem scale is explained by each model.

Patterns of associations for individual temperament and personality models Surprisingly, evaluating the amounts of explained variance indicates that the four trait models turn out to be rather comparable predictors of problem behavior. Moreover, examining the significance and magnitude of standardized betas corroborates many of the conclusions of the conceptual reviews on trait–maladjustment relationships. First, the relevance of studying children's traits relative to maladjustment is demonstrated by the finding that CBCL Total problems is significantly associated with each identified trait component, except Thomas and Chess's Threshold/Regularity and HiPIC Extraversion and Imagination. Second, across the different temperament and personality instruments, we found empirical support for the suggested patterns of

correlates of Internalizing and Externalizing. Results also corroborate several of the postulated divergences across temperament and personality frameworks.

As expected, all four trait instruments identify positive associations between *Emotionality/Neuroticism*-scales (i.e. BSQ Adaptability/Mood, EAS Emotionality, CBQ Negative Affect, HiPIC Emotional Instability) and Internalizing problems. Additionally, the three Emotionality-related scales stemming from the temperament questionnaires show the presumed positive associations with Externalizing problems and connect significantly with all five DSM-oriented scales. Yet, as anticipated, Internalizing and Externalizing are better differentiated by the HiPIC-personality framework which distinguishes *Benevolence* apart from Emotional Stability. Low Emotional Stability is hence primarily associated with Internalizing problems and has the most powerful associations with Affective and Anxiety problems whereas low Benevolence is the most powerful determinant of Externalizing problems and, at a lower level, Oppositional Defiant problems. Additionally, low Benevolence is moderately linked to Attention Deficit Hyperactivity (ADH-) problems. Yet, consistent with findings in general population samples with older children (e.g. Mervielde et al. 2005), this HiPIC-discrimination is not entirely clear-cut because Emotional Stability and Benevolence also contribute marginally to Externalizing and Internalizing.

Internalizing and Externalizing are further differentiated by the distinction – primarily advocated in temperament theory – between *Sociability* and *Activity*. This differential pattern becomes most evident from Buss and Plomin's model: EAS-Sociability is solely related to Internalizing and in particular Pervasive Developmental Problems whereas EAS-Activity is a major and exclusive correlate of Externalizing. Activity is also clearly represented in the temperament scales BSQ Activity/Persistence and CBQ Surgency. Both scales confirm the strong associations between Activity and Externalizing and its coherent links to ADH-problems and, to a lesser extent, Oppositional Defiant problems. The HiPIC-personality Extraversion component subsumes Sociability/Shyness-facets together with activity-related Energy. This more heterogeneous content is reflected by its associative pattern. Lower Extraversion goes together with higher Internalizing and in particular with Pervasive Developmental problems. The inclusion of the lower-order Energy-facet as part of the HiPIC Extraversion component might account for the supplementary minor association with ADH-problems ($\beta=0.18$).

In accordance with temperament and personality literature, all three models incorporating content related to *Conscientiousness/Effortful Control* (C/EC; i.e. BSQ Activity/Persistence, CBQ Effortful Control, HiPIC Conscientiousness) additionally reveal strong and negative relations between this trait and Externalizing. On a lower-level, low C/EC is

⁷ An additional joint principal component analysis, excluding the 23 children with an elevated score on the CBCL Total Problems scale, did not alter the documented six-factor solution. In subsequent analyses, we omitted children with significantly elevated scores on CBCL broadband scales. Again, dropping these children did not yield major changes of factor structure.

Table 3 Multiple Regression of CBCL Scale Scores on Temperament and Personality Component Scores

	TOT	INT	EXT	AF	AN	PD	AD	OD
Thomas and Chess model ($N=248$)								
Adaptability/Mood (R)	0.47**	0.49** ^a	0.36**	0.42**	0.43**	0.49** ^a	0.20**	0.40**
Threshold/Regularity	0.13	0.14	0.11	0.06	0.15	0.08	0.17*	0.12
Activity/Persistence	0.27**	0.12	0.39** ^a	0.22**	0.09	-0.02	0.49** ^a	0.25**
Multiple R^2	0.31	0.27	0.29 ^a	0.23	0.21	0.24	0.31 ^a	0.23
Buss and Plomin model ($N=273$)								
Sociability/Shyness	-0.17*	-0.25**	-0.07	-0.11	-0.16*	-0.39** ^a	-0.00	-0.08
Emotionality	0.42**	0.44** ^a	0.34** ^a	0.31**	0.36** ^a	0.34**	0.23**	0.34**
Activity	0.17*	0.00	0.33**	0.06	-0.03	-0.11	0.44** ^a	0.22**
Multiple R^2	0.23	0.25 ^a	0.23	0.11	0.15	0.28 ^a	0.25	0.17
Rothbart model ($N=279$)								
Surgency	0.28**	0.07	0.42** ^a	0.11	0.03	-0.07	0.46** ^a	0.34**
Negative affect	0.43**	0.48** ^a	0.27**	0.37**	0.51** ^a	0.33**	0.20**	0.27**
Effortful control	-0.24**	-0.19**	-0.27**	-0.16*	-0.05	-0.24** ^a	-0.22**	-0.23**
Multiple R^2	0.32	0.27	0.33 ^a	0.18	0.26	0.17	0.30 ^a	0.24
HiPIC-model ($N=423$)								
Benevolence (R)	0.33**	0.23**	0.43** ^a	0.15*	0.15*	0.12*	0.33**	0.46** ^a
Conscientiousness	-0.32**	-0.17**	-0.40**	-0.23**	-0.10	-0.12*	-0.39** ^a	-0.30**
Emotional stability (R)	0.32**	0.40** ^a	0.17**	0.28**	0.39** ^a	0.30**	0.20**	0.10
Extraversion	-0.08	-0.16**	0.02	-0.04	-0.11	-0.31** ^a	0.18**	-0.04
Imagination	-0.03	-0.08	-0.00	-0.05	-0.02	-0.11*	0.00	0.03
Multiple R^2	0.31	0.27	0.37 ^a	0.16	0.20	0.23	0.33 ^a	0.31
Six-factor joint model ($N=186$)								
Sociability (R)	0.25**	0.36** ^a	0.07	0.19*	0.30**	0.50** ^a	-0.05	0.09
Activity	0.25**	0.07	0.38**	0.11	0.05	0.01	0.50** ^a	0.26**
Conscientiousness	-0.36**	-0.29**	-0.33**	-0.31**	-0.28**	-0.16*	-0.33** ^a	-0.21**
Disagreeableness	0.36**	0.26**	0.44** ^a	0.22**	0.15	0.16*	0.24**	0.49** ^a
Emotionality	0.29**	0.36** ^a	0.17*	0.27**	0.38** ^a	0.15	0.19*	0.15
Sensitivity	-0.10	-0.10	-0.09	-0.06	-0.01	-0.13	-0.02	-0.12
Multiple R^2	0.46	0.41	0.49 ^a	0.26	0.33	0.34	0.45 ^a	0.41

Higher scores on scales denoted with (R) should be interpreted as more maladaptive

* $p < 0.01$; ** $p < 0.001$

^a The highest value per trait factor for the distinction among Internalizing and Externalizing and among the five DSM-oriented scales

TOT Total problems, INT internalizing, EXT externalizing; DSM-oriented problem scales: AF Affective, AN Anxiety, PD Pervasive developmental, AD attention deficit hyperactivity, OD Oppositional defiant

particularly implied in ADH-problems and, to a lesser extent, in Oppositional Defiant problems. The present results in preschoolers also provide some support for the recent suggestion by temperament researchers (e.g. Lonigan et al. 2004) that low C/EC-levels contribute to Internalizing as the present analysis of preschoolers reveals moderate regression coefficients for Rothbart's Effortful Control ($\beta = -0.19$) and HiPIC Conscientiousness ($\beta = -0.17$). Adopting a more fine-grained perspective shows that low C/EC is to some extent implied in Affective and Pervasive Developmental problems but is unrelated to Anxiety problems.

Finally, both Thomas and Chess's *Threshold/Distractibility* and HiPIC *Imagination* are not related to CBCL problem scales, except for minor associations between Threshold/Distractibility and ADH-problems ($\beta = 0.17$) and between Imagination and Pervasive Developmental problems ($\beta = -0.11$).

Patterns of Associations for the Joint Temperament and Personality Model Combining the scales from the three temperament models with those from the HiPIC into a six-factor model substantially increases the amount of explained CBCL-variance. While individual trait models explain between 25% to 27% of Internalizing and 23 to 37% of Externalizing variance, the six components explain respectively 41% and 49%. Additionally, whereas temperament models and the HiPIC explain on average 23% of the variance of DSM-scales, the six-factor model explains on average 36% of the variance of these scales. The fact that combining temperament and personality scales substantially increases the amount of explained CBCL variance indicates that temperament and personality are not redundant but rather complementary predictors of childhood behavior problems.

Examining the patterns of standardized regression coefficients shows that five of the six components derived

from the joint study of temperament and personality are significantly related to the CBCL Total problems scale, once more demonstrating a strong relationship between individual differences and concurrent maladaptation in preschoolers. Disagreeableness and Conscientiousness turn out to be the most powerful correlates, followed by Emotionality, Sociability and Activity. Notably, the Sensitivity component, which combines some content typical for parts of Rothbart's and Thomas and Chess's temperament model, is not a significant correlate of problem behavior.

Intriguingly, the analysis of the contribution of the joint components provides further evidence for the above described differential patterns of association with the different problems scales and shows that these patterns are even more distinctive than those observed for single temperament or personality measures. The joint analysis distinguishes *Emotionality* (mostly deriving its content from temperament scales) from *Disagreeableness* (primarily rooted in HiPIC personality scales but also encompassing anger/irritability), substantiating the links between Emotionality and Internalizing, and between Disagreeableness and Externalizing problems. Yet, these relations are not exclusive because of minor associations between Emotionality and Externalizing and between Disagreeableness and Internalizing.

Results further confirm the differentiation between *Sociability* (in the joint component analysis covering primarily Shyness scales derived from both temperament and personality models) and *Activity* (a typical temperament dimension). Sociability is exclusively related to Internalizing and in particular to Pervasive Developmental problems, while high Activity is distinctively connected to Externalizing and especially ADHD-problems.

Conscientiousness (primarily rooted by HiPIC personality scales) now turns out to be a rather unspecific correlate of both Internalizing and Externalizing. Notably, the six-factor model does not replicate the role of Conscientiousness as differentiating between Affective and Anxiety problems as it is also negatively related to Anxiety problems. Markedly, higher Activity, lower Conscientiousness and higher Disagreeableness all accompany higher scores on Externalizing and on ADHD- and Oppositional Defiant problems. However, the pattern of betas is quite different. Parallel to the suggestion that Activity relates to hyperactivity while low Conscientiousness associates with problems in attentional control, both Activity and Conscientiousness are mainly implied in ADHD-problems and show a weaker relationship to Oppositional Defiant problems. This latter scale is mainly linked to Disagreeableness.

Path Analysis of the Six-Factor Model to Internalizing and Externalizing Since the magnitude of beta weights does not provide sufficient ground for interpreting specificity in trait-maladjustment relationships, we further examined

direct effects of the six joint components as *simultaneous* predictors of both Internalizing and Externalizing by path analysis.⁸ In line with the proposal made by Mervielde and colleagues (2005, 2006) on personality-maladjustment relationships, we hypothesized that Emotionality and Sociability would be the main predictors of Internalizing while Conscientiousness and Disagreeableness would be the primary associates of Externalizing. As Activity and Sensitivity emerged in the present analysis as additional and independent trait components for preschoolers, we inferred from temperament research that Activity could emerge as a supplementary predictor for Externalizing whereas Sensitivity was not expected to predict CBCL problem behavior.

This top-down derived path model is shown in Fig. 1. Goodness-of-fit statistics indicated a good fit between this model and the data, with χ^2 ($df=27$, $N=186$)=19.96, $p=0.83$, and RMSEA=0.000. The incremental fit indices showed an excellent overall data-model fit, with NNFI=1.04 and CFI=1.00. Strong effects were found for low Sociability ($\beta=0.33$) and Emotionality ($\beta=0.29$) as predictors of Internalizing and for Disagreeableness ($\beta=0.39$) and Activity ($\beta=0.37$) as predicting Externalizing. A moderately negative effect was found for Conscientiousness ($\beta=-0.25$) predicting Externalizing. This model explained respectively 54% and 58% of the variance in Internalizing and Externalizing.⁹

Discussion

Temperament and Personality: Two Valid Languages Describing Preschoolers' Traits

Although temperament has been historically designated as the childhood precursor of later developing personality, the present comparison of the two frameworks in preschool children empirically breaks down this classic demarcation. Overall, psychometric analyses demonstrated acceptable scale

⁸ The path analyses are only based on Sample 2 data.

⁹ In order to find alternative paths, we also adopted a bottom-up approach sequentially dropping arrows from the fully-saturated model. In addition, modification indices were inspected that allowed to improve the fit of the model. In this way, we identified one competitive model which included an additional path between Conscientiousness and Internalizing. Goodness-of-fit indices were almost equal to the original model, but the ratio χ^2/df was less favorable for this model (0.44) than for the original model (0.74). Both models did not differ significantly from a model where all paths between traits and psychopathology were freed: original top-down model: $\chi^2\Delta$ (27, $N=186$)=19.96, $p>0.05$, alternative model: $\chi^2\Delta$ (26, $N=186$)=11.54, $p>0.05$. For reasons of parsimony and fit excellence, in addition to its theoretical basis, the original model was preferred.

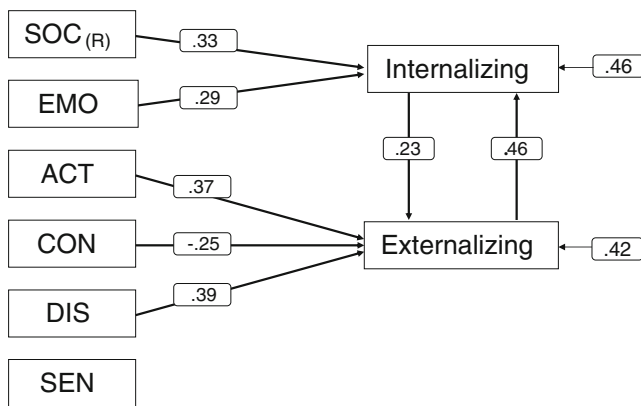


Fig. 1 Extended path model linking the six-factor model to CBCL Internalizing and Externalizing. Chi-square=19.96, $df=27$, p value=0.83, RMSEA=0.000 ($N=186$)

reliabilities for the temperament models of Thomas and Chess, Buss and Plomin, Rothbart, as well as for the five-factor based personality model. However, in line with previous work (e.g. Gibbs et al. 1987; Martin et al. 1994; Putnam and Rothbart 2006), internal consistencies of certain temperament scales (e.g. BSQ-Threshold, BSQ-Regularity, CBQ-Sadness) were also cause for concern within this sample. Noteworthy, reliabilities of the personality scales were generally higher than those obtained for the temperament scales. This might be partly explained by the fact that the content of the HiPIC-items was based on natural language child descriptions provided by Flemish parents, whereas the temperament items were imported and translated from the original English language versions. However, the internal consistencies of the 28 temperament scales were fairly comparable to those reported for the American (Buss and Plomin 1975; McDevitt and Carey 1978; Rothbart et al. 2001) as well as for the Dutch (Boer and Westenberg 1994; Majdandzic and van den Boom 2007; Super et al. 2008) standardization samples.

Principal component analyses confirmed the expected factor structures excepting the alleged nine-dimensional structure postulated by Thomas and Chess. Furthermore, the unmistakable emergence of the original HiPIC five-factor structure in this preschool sample is remarkable, even though this instrument was not targeted to this age group. Moreover, contrary to previous reports on the Big Five in preschoolers (Halverson et al. 2003; Lamb et al. 2002; Zupancic et al. 2006), we found no significant deviations from the traditional childhood or adult Big Five structure and even retrieved an independent and internally consistent fifth component similar to the Imagination factor usually recovered from HiPIC-ratings of school-age children. These findings add to the mounting evidence that traits in preschoolers can also be rightfully considered as personality (Caspi and Shiner 2006).

Common Dimensions Underlying Temperament and Personality Models

Because many studies use widely different trait measures, based on either temperament or personality concepts, one key question is how and how much temperament and personality measures overlap. The present study is one of the first that goes beyond a conceptual comparison as it addresses this question with a joint principal component analysis of 28 temperament and 18 personality scales. The six identified components were labeled Sociability, Activity, Conscientiousness, Disagreeableness, Emotionality, and Sensitivity. This analysis empirically corroborates Mervielde and Asendorpf (2000)'s proposal that—at least in preschool age—Activity constitutes an independent trait dimension not related to Sociability. It also supports Caspi and Shiner (2006)'s suggestion that Disagreeableness can be readily distinguished from Emotionality and Conscientiousness in 4- and 5-year olds.

This empirically-derived joint taxonomy corroborates but also refines and extends the current conceptual analyses of combined temperament and personality dimensions. First of all, the present analysis of preschool data does not yield the presumed distinct, independent Openness component but instead points towards a separate Sensitivity component which so far is not included in any of the conceptual taxonomies. Second, the joint structure identifies several semantically rather similar labels who do not completely share the same trait variance. For instance, conceptual interpretations have allocated the CBQ-factor Surgency as being related to Sociability (Caspi and Shiner 2006; Mervielde and Asendorpf 2000). Empirically, Surgency emerges as primarily activity-related because three of its four scales primarily load the joint Activity-dimension. Moreover, multiple regression analyses demonstrate distinct associations with problem behavior: Sociability primarily relates to Internalizing, while Surgency exclusively relates to Externalizing problems. Third, the joint analysis helps to decide on the location of the lower-order facets which have been narratively identified as 'conceptually ambiguous'. In the present preschool data, anger-irritability traits are more related to Disagreeableness than to Emotionality and impulsivity-related traits first and foremost load Activity and not Conscientiousness or Extraversion.

Unique Variance Captured by either Temperament or Personality

The present analysis also documents that temperament and personality comprise *unique* variance. This is particularly evidenced by the rather unbalanced distribution of temperament and personality scales within the six joint dimensions. Sociability can be considered as a well balanced

component representing content from both personality and temperament because it is primarily loaded by three of the 18 HiPIC (17%) facets and four of the 28 (14%) temperament scales. The composition of the other components is less balanced. Conscientiousness is primarily loaded by personality facets as eight of 18 (44%) HiPIC facets compared to two of 28 (7%) temperament scales have their highest loadings on this component. Disagreeableness is also dominated by personality content as five of 18 (28%) HiPIC facets versus only three of 28 (11%) temperament scales have their highest loading on this component. Activity, Emotionality and Sensitivity mainly draw their content from temperament questionnaires. Both Activity and Emotionality are each primarily loaded by seven of 28 (25%) temperament scales but only by one of 18 (6%) HiPIC facets. Sensitivity is exclusively loaded by five of 28 (18%) temperament scales.

The similarities and contrasts between temperament and personality are also revealed by the way they are associated with problem behavior. The multiple regression analyses illustrate that combining the content of both temperament and personality into a six-factor model increases the amount of explained CBCL variance with almost 50%, from 25 to 27% to 41% for Internalizing and from 23 to 37% to 49% for Externalizing. This implies that all four models contain—besides a common core—unique and complementary information enhancing the comprehensiveness of the joint model. Combining multiple trait scales in a joint model additionally reorganizes this information into orthogonal and internally more homogeneous (and hence more reliable) components resulting in increased power to predict problem behavior. Moreover, this more comprehensive six-factor model also permits more clear-cut discriminations among CBCL problem scales and enhances an evaluation of typical contributions of temperament or personality. For instance, when the six components are included in a path model as simultaneous predictors for Internalizing and Externalizing, the present study (with a restricted sample of children aged 4 and 5 years) favors a model with Sociability (represented in both temperament and personality models) and Emotionality (mostly temperament content) as the primary correlates of Internalizing and Activity (typical for temperament), Conscientiousness and Disagreeableness (primarily rooted in personality) as the prime correlates for Externalizing. Taken together, these findings show that, temperament and personality are neither entirely distinct nor completely redundant but rather complement each other.

Age-Related Patterns of Trait Structure

An additional strength of the current analysis is its age-specific assessment of trait structure in preschoolers

showing some divergences with the conceptual or narrative reviews. These differences might be attributed to idiosyncrasies of the sample and the applied instruments but may also be due to as of yet unnoticed age-specific trends in trait structure. Shiner (1998) describes two developmental mechanisms that may increase trait consistency from infancy through later childhood and adolescence. First, it is likely that traits progressively become more differentiated as children's maturation permits the development and expression of a broader set of personality characteristics based on an expanding behavioral repertoire. Second, parallel to this differentiation, the emerging individual differences may become increasingly integrated with one another. Both differentiation and hierarchical organization processes could account for the observed divergences between our empirical results and the structure proposed in the narrative reviews.

First, the Sociability component retrieved in the current preschool data combines Shyness/Inhibition scales with Sociability/Extraversion scales. However, there is some evidence that, later in development, sociability may become distinct from shyness (reflecting predominantly social inhibition with strangers). This differentiation may start in middle childhood (Boer and Westenberg 1994; Shiner 1998) when children can exert greater freedom of choice in selecting patterns of social interaction such as spending more time at home or away from social interactions. In addition, we found that in preschoolers, Activity constitutes a separate component independent from Sociability. As children age, their need for action may become partially satisfied by social activities like talking to (Eaton 1994) and sharing activities with others (Digman and Inouye 1986) and as such, activity level may become part of the broader Extraversion domain.

Second, the joint analysis establishes a Conscientiousness-component that goes beyond attentional processes and also includes personality-derived achievement motivation, orderliness, and self-confidence. Intriguingly, the joint principal component analysis of temperament and personality scales suggests that when six factors are extracted, HiPIC Imagination scales go together with Conscientiousness. Although it is not unusual to find that informants rating young children are unable to provide independent ratings for Conscientiousness and Openness/Intellect (Mervielde et al. 1995), the extraction of five principal components from the HiPIC clearly differentiates between Imagination and Conscientiousness. Presumably, this is because the HiPIC was constructed to measure independent Imagination and Conscientiousness factors. Adding 28 temperament scales, containing hardly any Openness/Imagination-related content to the HiPIC scales in a joint analysis, makes it much harder for the three HiPIC Imagination scales to surface as a major independent dimension.

With regard to childhood Openness/Imagination markers, Caspi and Shiner (2006) warrant that childhood Big Five studies primarily focus on curiosity, creativity and intellect whereas the adult measures for Openness also include openness to fantasy, aesthetics, feelings, and values. As Openness/Imagination relates to the need to seek novel and complex experiences and an eagerness to learn new things, recent evidence documents that Openness-to-Experience in adults is highly related to Rothbart's construct of Orienting Sensitivity (Evans and Rothbart 2007). Interestingly, the sixth component extracted from the joint analysis, also labeled as Sensitivity, turns out to be moderately correlated ($r=0.22$, $p<0.01$), with HiPIC Imagination. This might indicate that (Orienting) Sensitivity may be a preschool precursor for school-age and perhaps for adult Openness. However, life-span research is necessary to further document the developmental path from Sensitivity to Openness.

Can the Trait–Maladjustment Relationships be Explained by Item Overlap of the Measures?

Some have argued (e.g. Nicholls et al. 1982; Prior 1992) that the associations between traits and problem behavior are largely the result of item overlap as temperament, personality as well as maladjustment are all derived from similar types of questionnaire data. However, both conceptual analyses as well as empirical studies have promoted a more qualified stance on this issue.

First of all, it has been argued that when temperament/personality is contributing to the development of problem behavior, some conceptual overlap across constructs is theoretically to be expected (Bates 1990). The child's adjustment could indeed reflect a component of temperament, and problem behavior could be, at least in part, an extreme manifestation of a temperamental trait. However, according to this latter view, it becomes harder to explain points of divergence between measures designed to assess the two constructs (Frick 2004).

Second, it is important to note that although this kind of research generally documents relatively strong associations with specific forms of problem behavior, multiple R^2 's indicate that traits nevertheless account for only a limited proportion of the variance of problem behavior. The present research, for instance, shows that the individual trait models explain between 23% to 37% of the broadband behavioral problem scales. If traits and maladjustment were more alike than different, one would expect that these multiple R^2 's would be substantially higher and that trait–maladjustment relationships would be less specific.

Finally, the role of item contamination has been empirically evaluated for each of the trait instruments included in this research (see Eisenberg et al. 2004; Lemery

et al. 2002; Lengua et al. 1998; Prinzie et al. 2005; Sanson et al. 1990). These studies assessed item overlap by means of confirmatory factor analyses, psychometric analyses, expert ratings on semantic similarity, or a combination of these methods. Overall, these studies document that the amount of item contamination in trait and problem behavior measures is rather limited and demonstrate that removing confounded items generally does not affect the pattern of relations between traits and indicators of maladjustment.

Limitations and Future Directions

Some methodological constraints limit the generalizability of the present findings. The conclusions on the trait structure in preschoolers are restricted by the variable sample sizes and our choice of temperament and personality models, trait measures and informants. Future research could benefit from the inclusion of observational measures and structured interviews and from adopting multiple informant perspectives to assess children's traits. The conclusions on the trait–maladaptation links are also tentative because they solely rely on a one time broadband screening for behavioral problems in a general population sample. Hence, future research should investigate the robustness of the identified patterns of associations with more specific, narrowband diagnostic instruments in both general population and clinical samples of children. Additionally, this research should be supplemented by multi-wave longitudinal research to shed light on the temporal mechanisms that determine trait–maladjustment relationships and to chart distinct developmental pathways towards maladaptive outcomes. Finally, we acknowledge that childhood traits are only one of the many factors and transactional processes that contribute to the development of problem behavior. Hence, future work should explicitly test the relative contribution of trait variables in addition to other potential contributors such as parental behavior (e.g. Prinzie et al. 2005).

Future research should also continue the search for variables beyond traditional temperament or Big Five factors in order to detect—at each point in development—a comprehensive set of individual differences (Caspi and Shiner 2006). Therefore, similar research should be conducted with other age groups including side by side age-appropriate measures for both temperament and personality. Research in younger children is needed to detect at what time in development, personality type traits emerge and merge with temperamental variables. Research across several age groups is required to identify age-specific patterns in addition to across-age consistencies in trait structure and trait–maladjustment relations.

Yet, although previous research addressed the relationships between any given temperament or personality model

and maladaptation, the present study is the first to simultaneously evaluate multiple trait models with a sample of preschool children. This research also focused on parent reports of children's traits, while previous reports on the joint structure of temperament and personality (Angleitner and Ostendorf 1994; Digman and Shmelyov 1996) only included teacher or adult self-reports.

Overall, our analyses document that both temperament and personality are valid vehicles to describe traits in preschoolers but that they are not completely redundant. Locating temperament scales and personality facets in a joint structure reveals well balanced common content (Sociability), less balanced common content primarily loaded by temperament (Emotionality, Activity) or personality (Conscientiousness, Disagreeableness) and only one pure temperament dimension (Sensitivity). This joint model increases the discriminant validity because it provides a clearer differentiation among CBCL-problem behavior criteria. Hence, temperament and personality are neither completely independent nor totally redundant measures of individual differences among children. They have common as well as unique variance and as such complement each other as measures of individual differences and as correlates of problem behavior.

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